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Europe-Africa fixed link through the Strait of Gibraltar

Note by the Secretary-General

1. The Secretary-General has the honour to transmit to the Economic and Social Council the report prepared in accordance with Council resolution 2007/16 by the Executive Secretaries of the Economic Commission for Europe and the Economic Commission for Africa on the activities carried out within the framework of the project for a Europe-Africa fixed link through the Strait of Gibraltar.

2. The Economic and Social Council has been interested in this project since 1982, following the decision taken by the Governments of Morocco and Spain within the framework of a bilateral agreement on cooperation adopted on 24 October 1980 for the joint study of the feasibility of the project. Since that time, the Council has regularly requested the two regional commissions to follow the development of the project studies and keep it informed in that regard.

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Project for a Europe-Africa fixed link through the Strait of Gibraltar: report on studies and activities carried out during the period 2006-2009

Summary

The present report, prepared jointly by the Economic Commission for Europe and the Economic Commission for Africa pursuant to Economic and Social Council resolution 2007/16 of 26 July 2007, summarizes the work done under the authority of the Spanish-Moroccan Joint Committee by the two engineering firms, Sociedad de Estudios para la Comunicacion Fija a través del Estrecho de Gibraltar (SECEG) and Société Nationale d'Etudes du Detroit de Gibraltar (SNED), in connection with the fixed-link project.

The activities carried out from 2006 to 2009 mainly involved updating the preliminary pilot project for the basic option, the bored rail tunnel, and the traffic-forecasting model, the economic and financial evaluation, the environmental impact study, a study on the socio-economic effects of the project on its adjoining regions (Tanger-Tétouan in the south and Andalusia in the north), and an overall evaluation of various aspects of the project, in addition to activities concerning the experimental work in Malabata and Tarifa and studies of the cartography, geodesy and currents in the Strait of Gibraltar.

Future studies will be the subject of a specific programme, which is in the process of being developed, under the overall evaluation, and will be submitted for approval to the next session of the Committee to be held in Rabat in July 2009. This programme will focus on the implementation of supplementary activities aimed at answering certain remaining questions about the configuration of the site and specific studies to pursue certain aspects of the basic option.

The project also attracted the interest of the EuroMediterranean Transport Forum which took place in Brussels on 29 and 30 May 2007, and was presented to the European Commission at a special meeting held in Luxembourg on 8 June 2007 between the Moroccan and Spanish Ministers for transport and the Vice-President and European Commissioner for transport.

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I. Introduction

1. The Economic and Social Council, in its resolution 2007/16 of 26 July 2007, requested the Executive Secretaries of the Economic Commission for Africa and the Economic Commission for Europe to continue to take an active part in the follow-up to the project for a Europe-Africa fixed link through the Strait of Gibraltar and to report to the Council at its 2009 substantive session.

2. The purpose of the present report, prepared jointly by the two regional commissions on the basis of information obtained from the two companies in charge of carrying out the project studies, is to respond to the provisions of the resolution referred to above. The report includes, first of all, a brief summary of the progress made on the studies as of mid-2009 and, secondly, a summary description of the principal activities carried out in 2006-2009 and project development prospects.

3. It will be recalled that the studies for this project are taking place within the framework of the bilateral agreements signed by the Governments of Morocco and Spain, respectively, on 24 October 1980 and 27 September 1989, whereby the two parties agreed to study jointly the feasibility of the project for a fixed link through the Strait of Gibraltar on the basis of an equal sharing of costs, under the authority of a permanent intergovernmental Joint Committee, with the help of two State engineering companies, namely the Sociedad de Estudios para la Comunicacion Fija a través del Estrecho de Gibraltar (SECEG), whose head office is in Madrid, and the Société Nationale d'Etudes du Detroit (SNED), whose head office is in Rabat.

4. After several stages, the study process has been focused, since 1996, on the basic option comprising a tunnel driven beneath the sill of the strait, comprising two unidirectional rail tubes connected to a central service and safety gallery. The functional design, which is similar to that of the Channel Tunnel, allows for the interconnection of the two countries' railway networks and, in addition, the crossing of road vehicles on shuttle trains running between two terminal stations, one in Spain and the other in Morocco. Typical lengths for the structure in its current form would be 42 kilometres (km) between terminals, 37.7 km of which would be tunnel, including 27.7 km of undersea tunnel. This basic option, identified in 1996, is currently being revised in the light of newly acquired geological and geotechnical data and evaluated within the framework of an overall evaluation of the project, which could give rise to changes in the longitudinal profile and functional design.

5. Owing to technical and economic considerations and subject to the results of the studies on the development of relevant aspects of the basic option, the construction process envisaged comprises three successive phases, namely: (a) phase 0, consisting in the driving of an undersea exploration tunnel; (b) phase 1, in which the project could be operated in "single-tube" mode (construction of the first rail tunnel and the service and security gallery); and (c) phase 2, which would include the construction of a second rail tunnel, so as to permit "dual-tube" operation, once the traffic demand warranted it.

6. In the study process for the fixed link through the strait, strong emphasis has been placed on marine geological investigations involving four deep underwater drilling campaigns, the last of which, carried out in 2005, provided highly interesting information on the nature of the geological formations to be traversed by the future tunnel. This made it possible to define the longitudinal profile of the alignment with greater precision.

II. Activities carried out in 2006-2009

7. At its thirty-ninth meeting, held in Madrid on 27 and 28 November 2006, the Joint Committee approved the revision of the workplan for 2004-2006, and its extension to 2009 was confirmed at the fortieth and forty-first meetings of the Committee, held at Rabat on 30 January 2008 and Madrid on 12 February 2009 respectively. The revised workplan for 2004-2009 thus anticipates the completion of: (1) the reformulation of the preliminary pilot project (PPP) for the tunnel option, also integrating aspects of the environmental impact; (2) the update of the traffic forecasting model for the project, with the aid of an econometric model and the study on the socio-economic effects of the project on the adjoining regions; (3) the study of the legal and institutional framework within which the project will be developing; and (4) an overall technical, socio-economic, financial, legal and environmental evaluation of the project. The principal studies carried out during the period 2006-2009 were:

- An update of the preliminary pilot project (PPP-07) for the tunnel option.
- The environmental impact study for the project.
- The development of a traffic forecasting model, integrating the economic and financial assessment.
- The regional effects of the project.
- The overall project evaluation.

A. Update of the preliminary pilot project

8. The aim of the PPP-07 study was both to update the results of the previous study (PPP-96), following the subsequent discovery of two palaeochannels (troughs) filled with Quaternary material (breccia) in the middle of the strait, and to study whether those deformable materials are suitable for tunnelling and look into appropriate drilling methods. The principal conclusions of the study's various mission reports can be summed up as follows:

- The geological report, on the basis of an analysis of all the available data, proposed a longitudinal section, specifying the distribution of the various flysch deposits and breccia along the route.
- The total length of the two troughs at the level of the tunnel at 475 metres below sea level is estimated to be 2.8 km, though a plausible pessimistic hypothesis could put it at 4.8 km.
- The geotechnical report synthesized all the information and data collected since the project's studies began and presented some of the mechanical properties of the different formations the proposed tunnel will cross. The basic properties of each formation were used for the geomechanical analysis.
- These geotechnical parameters (basic properties) were put into a three-dimensional geomechanical model, according to the different scenarios put forward as to the extent of the excavations and drainage needed to cross the problematic areas, as well as hypotheses about the properties of the materials traversed.

- Technological improvements in tunnel boring machines would be desirable in order to cross the breccia at a reasonable rate of progress.
- Since there are major variations in the mechanical properties of the formations, it is crucial to understand these materials better before definitive and sufficiently well-founded conclusions can be made. This requires a deeper knowledge of the geomechanical nature of the breccia or, more generally, of the materials filling the troughs, in order to have a reliable basis for choosing an excavation method. A subsea drilling campaign will be required, even though it may only provide limited results, due mainly to the vertical structures of the materials.
- It is thus necessary to drill an exploratory gallery from the Moroccan side. This would also provide an opportunity to evaluate the characteristics of the tunnel boring machine and the measures to take into account as progress is made, in order to determine the combination of methods that will make it possible to carry out the project. The experience and knowledge acquired from these additional explorations will determine whether the rail tunnels are possible and how they can be constructed.
- The project update included studies of the ventilation and safety of the structure. The layout of the underground structures, as in PPP-96, has been significantly modified as a result of major technical and normative developments over the past 10 years.

9. A mission to appraise the preliminary pilot project reports, in particular those regarding geotechnical and geomechanical aspects, was organized by the engineering firms, enabling them to decide on a strategy for future investigations. The mission confirmed the direction of the study and the observations and restrictions noted by the study consultant.

B. Environmental study

10. The study of the environmental impact of the project was able to provide a systematic evaluation of the potential impact of each element of the various phases of construction and operation on the flora, fauna, the neighbouring population and on the site itself. It also highlighted the level of project optimization in the study area, determined the environmental acceptability, identified measures to mitigate the impact and, lastly, enabled the costs of the measures to be taken during construction and operation to be estimated.

C. Traffic forecasting model

11. The traffic forecasting study provided an update to the previous traffic estimates for the tunnel through the Strait of Gibraltar for 2030, 2040 and 2050, based on socio-economic development scenarios for the countries in the region. According to the scenario based on current trends, in 2030, an estimated 10 million passengers and 7 million tons of merchandise would be using the tunnel, and according to the best-case scenario, "European Union association with the Maghreb countries and growth in Europe", there would be 13 million passengers and 9 million tons of merchandise.

12. In addition to this study, up-to-date economic and financial assessments based on recent studies, notably the tunnel option preliminary pilot project (PPP) and the traffic forecast study, have just been completed.

D. Regional effects study

13. The study of the regional effects of the project analysed and assessed its local impact, for instance its influence on added value and human activity, land usage and transport networks. The standardized methodology of input-output tables was used to calculate the socio-economic effects of the project's construction and operation on neighbouring regions (Tangier-Tétouan to the south and Andalusia to the north). The study found that those regions would develop rapidly, especially on the southern side, due to a stronger association of Morocco with the European Union, and the greatest benefit from the execution of the project would be in the area of production (a significant proportion of the expenditure will be generated by the regions themselves, especially on the northern side) and in terms of direct and indirect job creation (approximately 120,000 full-time equivalent posts, including around 80,000 direct posts, distributed as follows: 40,000 on the southern side and 80,000 on the northern side).

E. Overall evaluation

14. The objective of the overall evaluation is to draw up an end-of-stage report, based on the evaluation of the project as a whole and of its feasibility, providing an in-depth analysis of its technical characteristics, the phases of its implementation, elements of socio-economic and environmental evaluation and the costs and time frames for its construction.

15. On 7 and 8 January 2009, at the launch of the overall evaluation, the engineering firms held a seminar bringing together the key officials from the groups responsible for the technical and socio-economic studies and officials from the group conducting the evaluation. This meeting provided an opportunity to brief the participants from the evaluation group on the results of the studies carried out and to examine the technical and socio-economic strategies and options proposed, in particular for the most significant difficulties in the project, while giving particular attention to the technical and financial feasibility of the exploratory gallery, which will affect that of the tunnel as a whole.

16. The study is being finalized and the preliminary conclusions are as follows:

- The project is an essential link in the development of a Europe-Africa land transport network, especially for the western Mediterranean, which should promote exchanges in the region.
- The available information about the geological conditions and geomechanical properties show that drilling through the two palaeochannels could be extremely difficult. The time and money needed for the excavation work could jeopardize the economic feasibility of the project.
- The uncertainties, both about the geometrics of the palaeochannels and the geomechanical properties of the solution breccia, are too significant for such a major project. Taking decisions based solely on the results of the tests and

parametric analyses currently available would be risky. Further explorations and studies are crucial.

- Considering the size, importance and exceptional nature of the project, a more extensive programme of investigation would be justified, as is the practice for other similar projects.
- The exploratory gallery itself is a major undertaking in comparison to standard projects. Therefore, the feasibility of that gallery itself should be demonstrated with a degree of certainty.
- Further, more intensive studies should be carried out upstream, in order to expand certain aspects of the PPP-07 study. These basic studies will aim to review the project's options through a more thorough and objective analysis of the scenarios that could be considered.
- The tunnel under the Strait represents more than just a technical feat — the project is not simply infrastructure linking two continents, it is also a service offered to very large and transnational groups of people. An exact definition of the transport offering and a demonstration of its advantages are thus essential, because in the eyes of potential users, the project and the service offered are one and the same.
- The current project is seeking to reduce investment costs and adapt them to traffic demands by using a very difficult rail profile (slopes and gradients of 30 per cent over 17 kilometres), an approach to rolling stock requiring a rapid pace, use of open railway equipment, etc., and by carrying out the construction and operation in two phases: a first phase involving a single-track rail tunnel, to be operated in bursts, and a service/safety tunnel; and a second phase to construct a second rail tunnel.
- An option with a reasonable probability of technical feasibility and that respects the time frame set out by the engineering firms (a reasonably feasible option) should be identified and examined in more detail. This examination should lead to a construction plan and the establishment of a list of actions intended to reduce uncertainties and consolidate costs for the duration of the project, thus providing a solid basis for decision-making.

III. Other activities carried out from 2006 to 2009

A. Cartography

17. The 1:25,000 scale geological maps of the north and south shores have been drawn up. They are updated regularly as new data are collected.

B. Geodesy

18. Cooperation with the Instituto Geográfico Nacional in Spain and l'Agence Nationale de la Conservation Foncière, du Cadastre et de la Cartographie in Morocco, based on a partnership agreement, is for the purpose of performing the three activities:

- Establishment of a geodesic network of permanent GPS stations to carry out geodynamic observations in the Strait of Gibraltar.
- Establishment of a Strait of Gibraltar altimetric network. The precision levelling has been partially completed and the network is finished on the south shore. The north/south link must still be programmed through optical observations, to be carried out after a test survey.
- Updating of the physical map of the Strait.

C. Experimental work

19. At the Malabata site, closed in 2007, the platform around the well head on the surface was made watertight and strengthened, to preserve it for possible visits in the future.

20. The Tarifa gallery is being kept open. It is used, among other things, to store core samples taken from the various offshore drilling surveys. A new survey of relative convergence measurement in the gallery was carried out on 4 and 5 November 2008 and shows that the deformations as a whole are stable, with the exception of certain areas in the Almarchal argillites.

D. Additional geotechnical tests on the breccia

21. Additional geotechnical tests on the breccia were performed by the engineering firms under an agreement with the Institute for Geotechnical Engineering, of Zurich, Switzerland. Twenty core samples taken from two offshore drilling surveys were chosen. Those samples are currently being tested.

E. Marine currents

22. Under a partnership agreement with the University of Cadiz, measurements of sea currents were taken in the Strait to calibrate the current prediction models in the area, by:

- Anchoring new current metres on the Spanish and Moroccan continental shelves, during the "Sarmiento de Gamboa-2008" campaign.
- Determining the harmonic constants of the current velocities at the level of the shelves, based on newly collected data.

23. The "Sarmiento de Gamboa-2008" campaign, from 14 September to 12 October 2008, was carried out to collect new data to improve knowledge of the hydrodynamic system of the marine currents and the distribution of the biological variables in the Strait of Gibraltar, in order to consolidate, in particular, the water circulation models and to fine-tune the current prediction programme of the University of Cadiz. It was begun as part of the cooperation between the engineering firms and the University of Cadiz, with the participation of Abdelmalek Essaadi University (Morocco), Malaga University (Spain), the Instituto Nacional de Técnica Aeroespacial (Spain) and the Instituto Hidrográfico de la Marina (Spain).

24. Three current metres were anchored on the Moroccan and Spanish continental shelves and in the north of the northern palaeochannel. Physical measurements (conductivity, temperature, density), water and plankton sampling and an overflight of the area were carried out at specific times, according to tide levels, to monitor displacement of the surface of the water.

25. Measurements of the current allow the engineering firms to update the current prediction model in the deep waters of the sill of the Strait, which was very useful for scheduling and conducting the offshore drilling surveys. In that regard, under the partnership with the University of Cadiz, all the necessary data will be processed by a computer program developed by the University to be included in the current prediction model.

F. Website

26. A joint SNED-SECEG website for the project is available in Arabic, English, French and Spanish, at www.sned.gov.ma or www.secegsa.com.

IV. Future work

27. A programme of future activities is being prepared as part of the overall evaluation and will be submitted to the forty-second meeting of the Joint Committee, to take place in Rabat in July 2009.

V. External relations

A. Moroccan-Spanish high-level meeting

28. The high-level meeting between Spain and Morocco, held in Rabat on 5 and 6 May 2007, heard a joint presentation on the current status of project studies prepared for the President of the Spanish Government and the Moroccan Prime Minister. It was decided at that meeting that the project should be presented to the European Commission in order to involve it in its development.

B. European Commission

29. The Moroccan and Spanish Ministers and Jacques Barrot, Vice-President of the European Commission and Commissioner for Transport, met in Luxembourg on 8 June 2007 specifically to discuss the project. That meeting gave the two delegations the opportunity to present to European officials the results of the studies for the fixed link project, the prospects for its completion and the development plans for its north and south railway links, and to request institutional support from the European Union for the development of the project. The parties present at that meeting have agreed as follows:

- The two Ministers will submit an official written request for institutional support from the European Commission for the development of the project, accompanied by a report on the results of the project studies and prospects for

its completion. That request has been made to the European Commission by the two Ministers.

- European Commissioner Barrot suggested to the Commissioner for External Affairs, Benita Ferrero-Waldner, that a broader meeting should take place to examine the request of the two Ministers for institutional support for the project.

C. EuroMediterranean Transport Forum

30. The EuroMediterranean Transport Forum, held in Brussels on 29 and 30 May 2007, examined and adopted the Regional Transport Action Plan for the period 2007 to 2013. The Plan, drafted on the basis of the trends of the first EuroMediterranean Ministerial Conference on Transport, held in Marrakesh on 15 December 2005, is a road map to intensify cooperation in transport in the Mediterranean region. It includes a number of actions in various modes of transport, relating to infrastructure planning and reform of transport service regulations. Its annex contains a list of priority projects, including the fixed link through the Strait of Gibraltar. A working group on "Infrastructure and Regulation", bringing together experts in the field of transport, has been established to steer the Plan and to facilitate coordination of regional priorities and national strategies, while stressing transboundary projects in order to intensify regional integration.

VI. Conclusions

31. The results of the last offshore drilling campaign removed a number of geological uncertainties regarding the central portion of the undersea alignment of the project. The engineering study currently in progress will serve to define the geometric and functional characteristics of the exploratory gallery called for by the basic option adopted for the project and, subsequently, those of the rail tunnel for which that option provides. The environmental study evaluated the impacts of the project in that area and the measures needed to counter them. The socio-economic and traffic-forecasting studies will help to define the remaining variables needed to evaluate the project.

32. The technical, environmental, socio-economic and legal parts of the overall evaluation stressed the questions to be answered in the study of the geotechnical characteristics of undersea geological formations (breccias) and shortcomings in the development of certain technical and security aspects of the basic option.

33. The workplan that will be prepared as part of the overall evaluation and submitted for the approval of the Joint Committee will open the way to a new phase in which even more important new tasks will have to be undertaken to work out the solutions for a project of such magnitude.